Science informed water resources decision-making:
Examples using remote sensing in East Africa, the Lower Mekong Basin and the western United States

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Hypothesis

Estimates of key hydrologic variables derived from remote sensing observations can improve water resources decision and policy making.

An Increasingly Scarce Global Resource

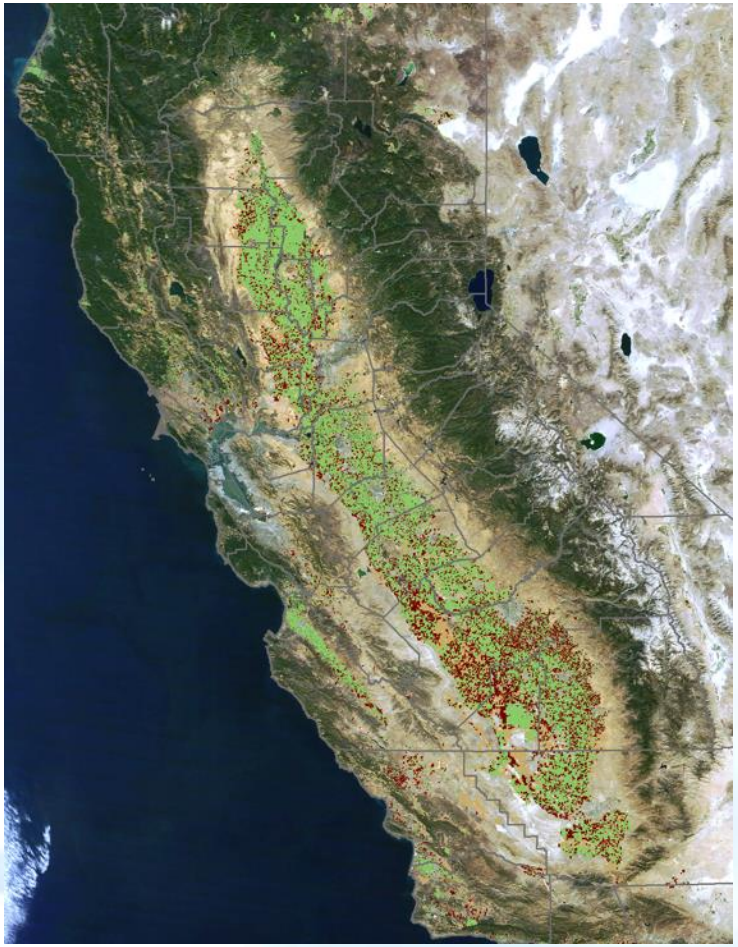
- **Two thirds** of the world's population live in areas that experience water scarcity for at least one month a year. *(Mekonnen and Hoekstra, 2016)*
- **1.8 billion people** are expected to be living in regions with absolute water scarcity by 2025. *(UNESCO, 2012)*
- By 2030 humanity's "annual global water requirements" will exceed "current sustainable water supplies" by **40%**. (*U.S. Intelligence Community Assessment of Global Water Security, 2012)*

Leveraging “new” Information and Knowledge

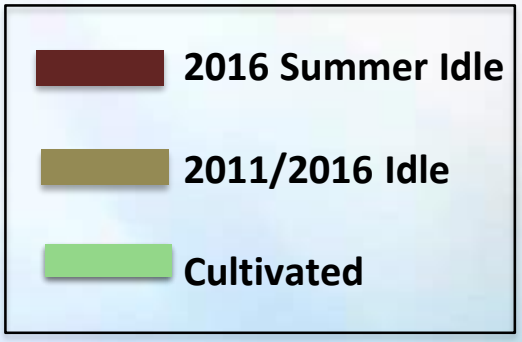
- Water management data often exist in silos.
- Global remote sensing observations could benefit water management.
- However, RS estimates may be under utilized for a number of reasons including:
  - Difficulties in integrating disparate data sources
  - Lack of knowledge/expertise/resources to use new data sources
  - “Big data”

Determining the Extent of Fallowed Land

PROJECT TEAM: NASA Ames Research Center, USGS, USDA National Ag. Statistics Service, California Dept. of Water Resources, NOAA, California State University Monterey Bay

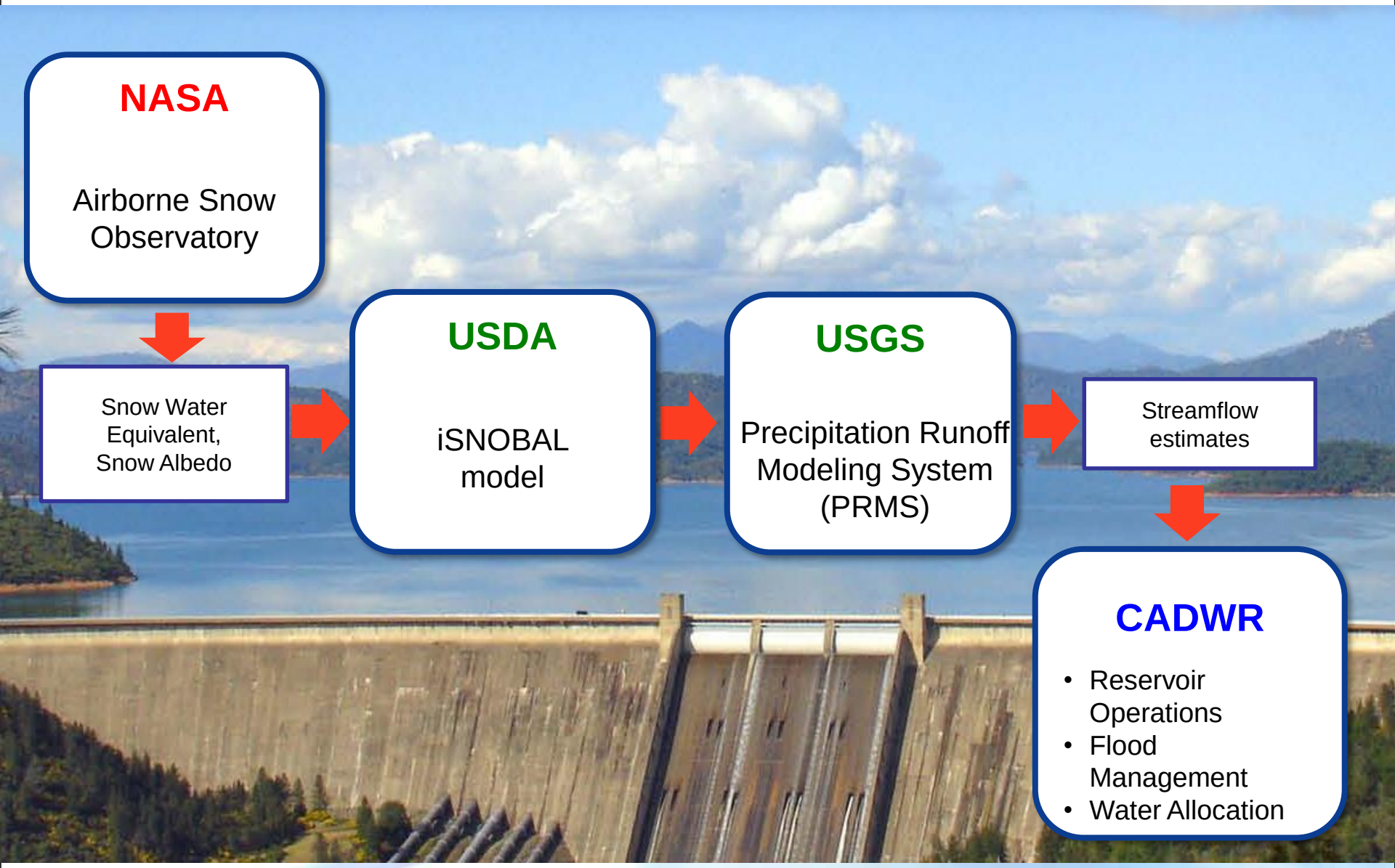


2016 Summer Land Fallowing

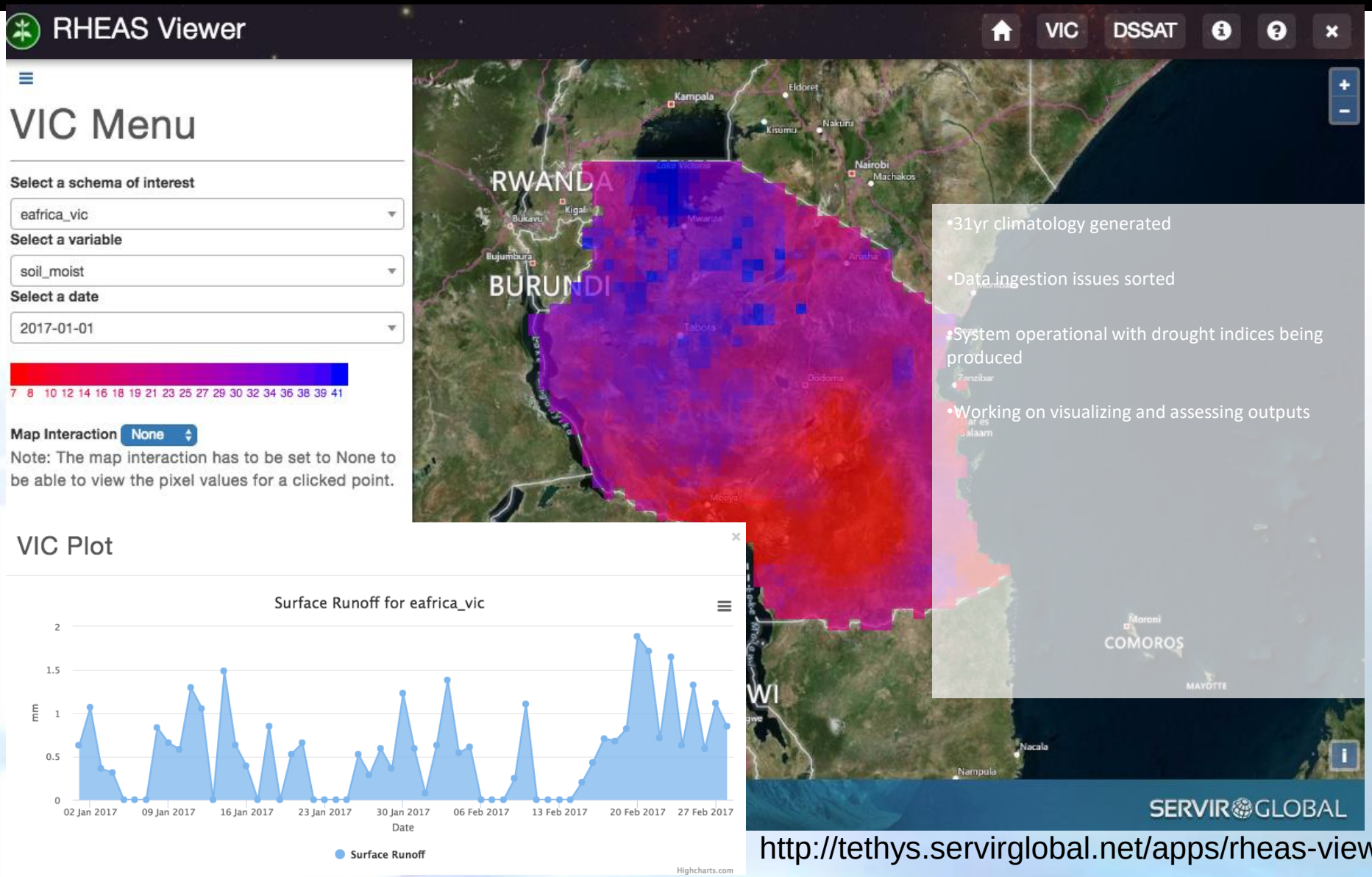


https://nex.nasa.gov/nex/projects/1372/

Application of RS in western United States:
ASO iSNOBAL Model Integration



East Africa:
RHEAS Drought and Crop Yield



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East Africa:
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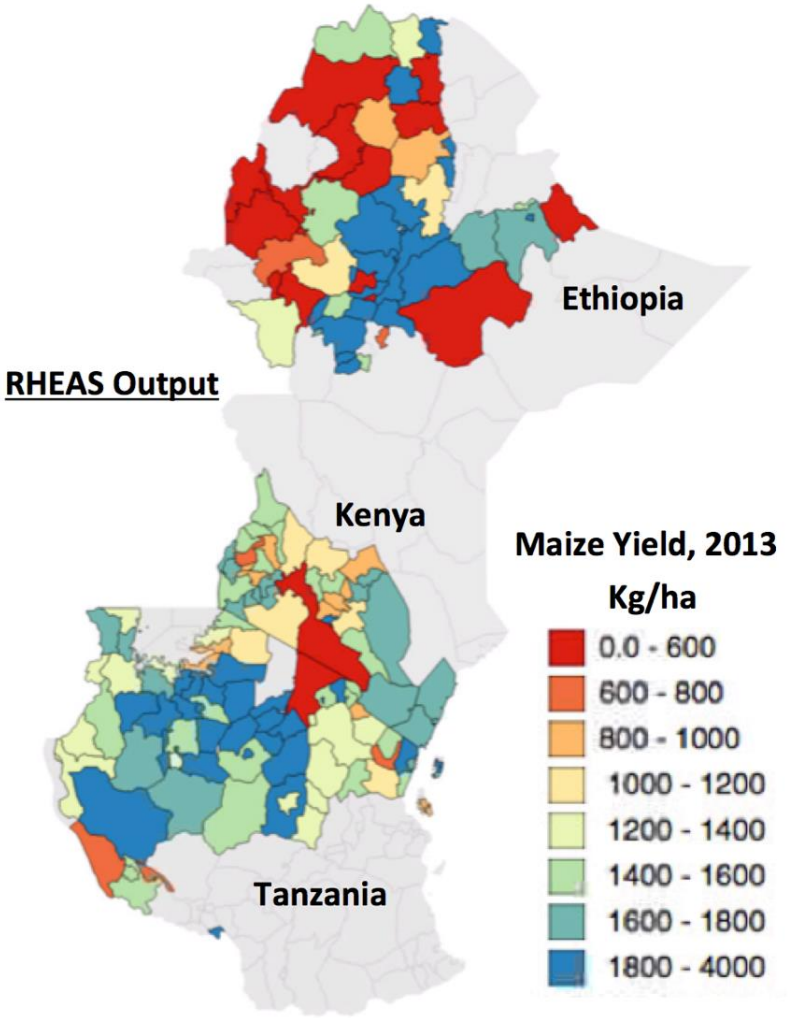
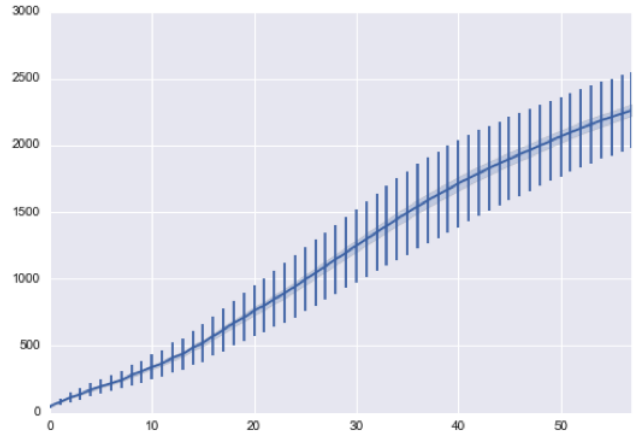
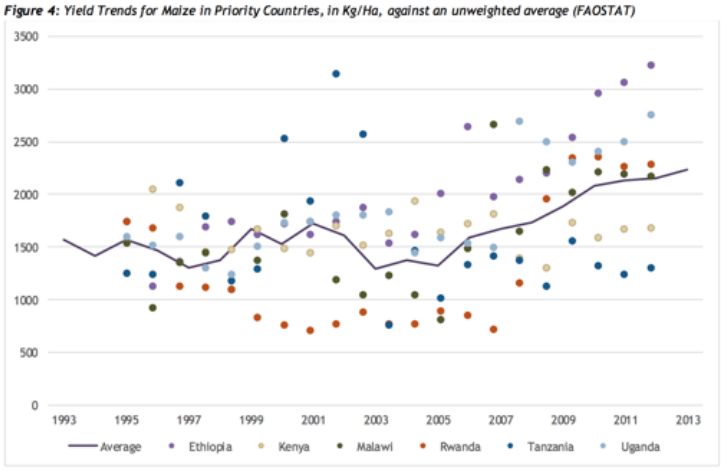


2013 maize yield in Ethiopia, Kenya, and Tanzania at the county/district level.

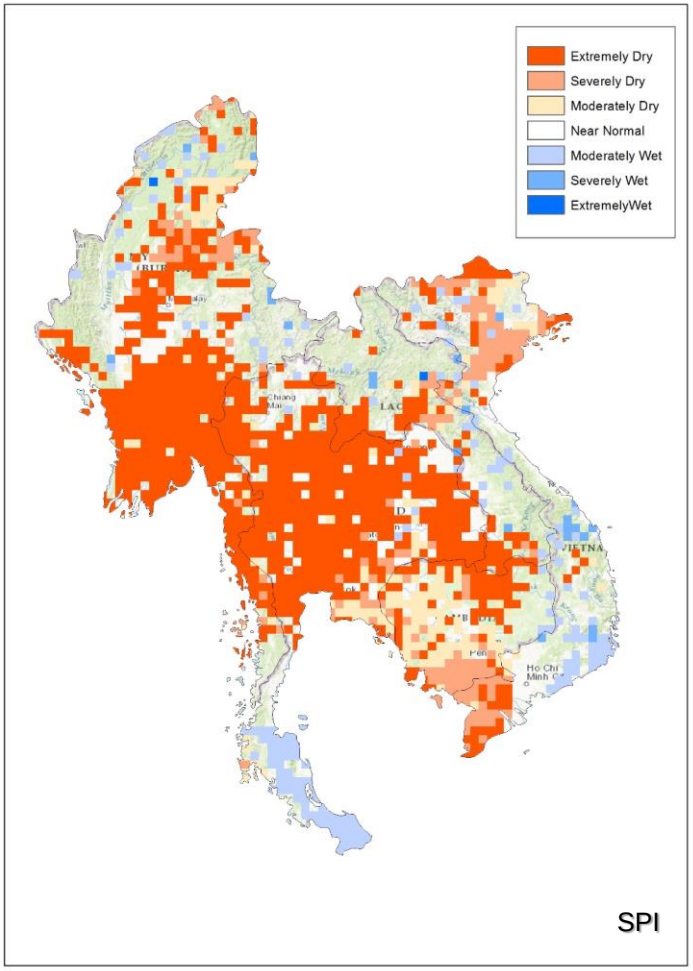


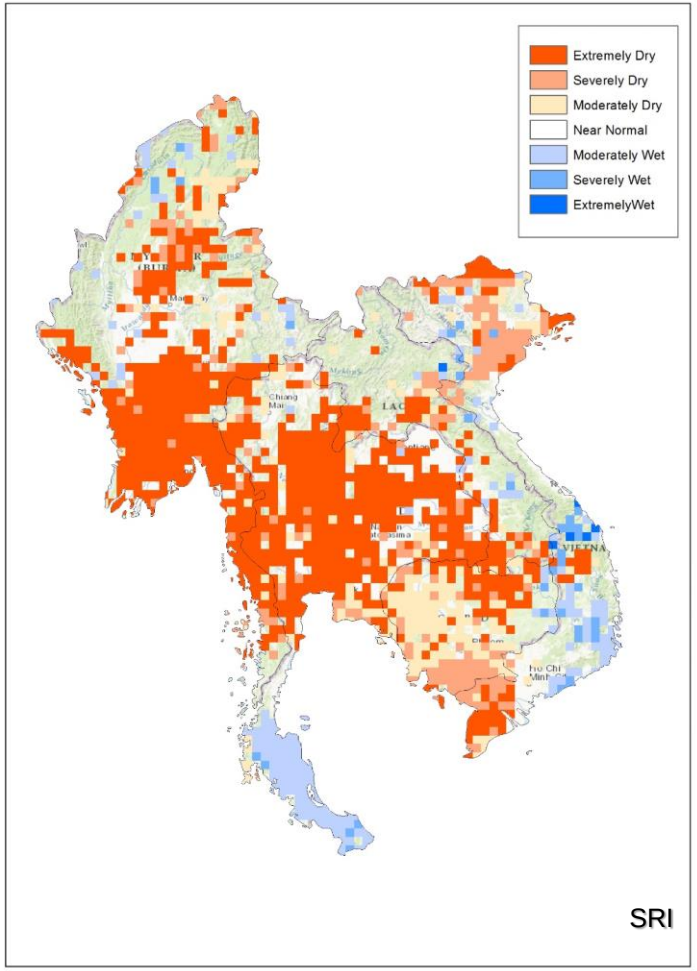
RHEAS Kenya Highlands DSSAT Yields, kg/ha (1 season, 2013, ~June-July), Courtesy RCMRD



Long-term regional yield trends (FAO). Courtesy Lee Ellenburg, SERVIR-CO & RCMRD

Lower Mekong Basin:
Products (SPI and SRI): Nowcast – December 2016





Lessons Learned and Best Practices

- **Lessons Learned**
  - Sustainability of observations is a risk for water management.
  - Big Data: Water managers don't have the tools or the time to handle the fire hose of data! Volume, Velocity, Variety
  - Decision makers may have policy barriers in place that keep them from using modern platforms.
- **Best Practices**
  - Work with existing toolsets and data…don't reinvent the wheel!
  - Find a champion and build on that relationship to develop trust in the community.
  - Create cross-disciplinary teams with decision makers to co-develop projects.
  - Keep "surveying" the landscape to maintain understanding of the state of the practice and to identify gaps and needs.

Summary

Hydrologic estimates derived from remote sensing have been shown to be useful to support and improve water management.

- Airborne observations of snow water equivalent provide estimates of snow properties at elevations that are out of reach for existing sensing networks.
  - *These estimates are complementary to existing in situ networks*.
- Homogeneous observations of land use provide large scale monitoring for large-scale fallowing programs.
- Global remote sensing estimates are used to inform hydrologic and crop models in “data poor” regions – filling an important gap for policy and decision making in the developing world.
- Challenges exist, but they are not insurmountable.
- Engagement with stakeholders and capacity building is critical for effective application of scientific observations for decision support

Questions?

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